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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/692,772	10/24/2003	Laura Wills Mirkarimi	10031180-1	8958
57299	7590	02/08/2006	EXAMINER	
AVAGO TECHNOLOGIES, LTD. P.O. BOX 1920 DENVER, CO 80201-1920			VINH, LAN	
			ART UNIT	PAPER NUMBER
			1765	
DATE MAILED: 02/08/2006				

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/692,772	Applicant(s) MIRKARIMI ET AL.	
	Examiner Lan Vinh	Art Unit 1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 January 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6 and 8-21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6 and 8-21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 1/25/2006 has been entered.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 18 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 18 recites the limitations "said third gas" and "said fourth gas" in claim 8. There is insufficient antecedent basis for this limitation in the claim.

Claim Objections

3. Claim 17 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent

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form, or rewrite the claim(s) in independent form. Claim 17 requires a limitation of "the concentration of the second gas is in the range from about 5-75 % by volume". The limitation is already required in claim 1

Double Patenting

4. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 8, 9, 11-18, 19-21 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-6, 9, 12-17, 20 of copending Application No. 10/765,647 in view of Shul et al (US 5,624,529)

This is a provisional obviousness-type double patenting rejection.

Claims 1-6, 9, 12-17, 20 of copending Application 10/765,647 meet all the limitations of the instant claimed invention except the usage of BCl₃ gas and exposing the portion

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of the III-V semiconductor material to the etching mixture to etch smooth aspect ratio sidewall. Shul discloses a dry etching method for compound semiconductors comprises the step of exposing the portion of the III-V semiconductor material to the etching mixture comprises BCl₃, CH₄ and H₂ to etch smooth aspect ratio sidewall (col 6, lines 42-45; fig. 1). One skilled in the art at the time the invention was made would have found it obvious to modify claims 1-6, 9, 12-17, 20 of copending Application 10/765,647 to include BCl₃ in the gas etching mixture to etch smooth aspect ratio sidewall in view of Shul teaching because Shul discloses that under the condition of using BCl₃ and other etch parameters, the dry etch is highly anisotropic with a substantially smooth surface morphology (col 6, lines 45-55)

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1-5, 8, 10, 17, 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanabe et al (US 6,893,971) in view of Shul et al (US 5,624,529)

Tanabe discloses a dry etching method of an InP-based compound. The method comprises the steps of:

forming a mask on the InP-based substrate/III-V based compound (col 6, lines 1-4)

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placing the InP substrate and the mask into a reactor having a pressure of 0.5 Pa/3.7 mTorr (which overlaps the claimed range between 2 mTorr to about 20 mTorr) (col 8, lines 18-20)

introducing a first gas of HI/a gas chosen from group VII gaseous species into the reactor (col 7, lines 38-40).

introducing a second gas of BCl₃ into the reactor (col 7, lines 36-37)

exposing the InP substrate/the III-V based compound to a gas plasma comprises HI and BCl₃ for deep via holes having a sidewalls etching fabrication and then make it possible to control fabrication shape into a desired shape, a mirror finish of the surface can be achieved (col 9, lines 40-65; fig. 7a), which reads on exposing the InP substrate/the III-V based compound to a gas plasma comprises the first and second gas to etch smooth high aspect ratio sidewalls

Unlike the instant claimed inventions as per claims 1, 17, 19, Tanabe fails to disclose that BCl₃ is present in the reactor at a concentration of about 5 to about 75% by volume

Shul discloses a dry etching method for compound semiconductors comprises the step of exposing the portion of the III-V semiconductor material to the etching mixture comprises BCl₃, CH₄ and H₂ wherein the concentration of BCl₃ is 11 % by volume (col 6, lines 42-47)

One skilled in the art at the time the invention was made would have found it obvious to modify Tanabe method by using the specific concentration of BCl₃ as per Shul because Shul discloses that for etching indium containing material, a preferred plasma

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composition is about 5 sccm BCl₃/ 11 % volume of BCl₃ in the total volume of the etching gas mixture (col 42-45)

The limitation of claim 2 has been discussed above

Regarding claim 3, Tanabe discloses using dry etching/RIE etching (col 4, lines 19-22)

Regarding claim 4, Tanabe discloses generating the plasma using high-frequency power and inductively coupling plasma (col1, lines 10-13)

Regarding claim 5, Tanabe discloses using a RF generator to provide power at 100-150 watts and a high frequency power at 700-900 Watts (col 10, lines 10-15)

Unlike the instant claimed invention as per claim 8, Tanabe fails to disclose introducing CH₄ and H₂ into the reactor. Shul also discloses exposing the portion of the III-V semiconductor material to the etching mixture comprises BCl₃, CH₄ and H₂. One skilled in the art at the time the invention was made would have found it obvious to modify Tanabe by introducing CH₄ and H₂ into the reactor as per Shul because Shul discloses that for etching indium containing material, a preferred plasma composition includes BCl₃, CH₄ and H₂ (col 6, lines 43-46)

Regarding claim 10, Tanabe discloses adjusting the temperature of the InP substrate to 50-150⁰ C (col 3, lines 42-43)

7. Claims 6, 9, 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanabe et al (US 6,893,971) in view of Shul et al (US 5,624,529) and further in view of Bhardwaj et al (US 6,261,962)

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Tanabe as modified by Shul has been described above. Unlike the instant claimed inventions as per claim 6, 9, 18, Tanabe and Shul fail to disclose the specific concentrations/ratio of CH₄ and H₂ although Tanabe discloses that the flow rate of the mixed gas can be adjusted (col 10, lines 50-53)

Bhardwaj discloses a method for etching semiconductor substrate comprises the step of adjusting the flow rate of etchants such as CH₄ and H₂ (col 35-40). Bhardwaj also discloses that a parameter such as the gas flow rate may vary with the time (col 2, lines 38-42). Bhardwaj serves as an evidence that gas flow rate is a result effective variable

Hence, one skilled in the art at the time the invention was made would have found it obvious to adjust/controlling any concentration/proportion of the etchants in Tanabe and Shul method in view of Bhardwaj teaching because Bhardwaj discloses that by controlling the gas flow rate, the system can be turned in an appropriate manner to achieve good anisotropic etching with proper sidewall passivation (col 8, lines 13-17). Also, it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. See *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CPA 1980)

8. Claims 11-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shul et al (US 5,624,529) in view of Jewell et al (US 5,034,344)

Shul discloses a dry etching method for compound. The method comprises the steps of:

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forming a mask 16 on the III-V based compound (AlInP) (col 4, lines 9-10, col 6, lines 33-35; fig. 1)

placing the III-V compound and the mask into a reactor having a pressure of 0.5 – 20 mTorr (which overlaps the claimed range between 2 mTorr to about 20 mTorr) (col 6, lines 9-10)

introducing a first gas of Cl₂, a second gas of BCl₃, CH₄/third gas and H₂/fourth gas into the reactor (col 6, lines 21-23)

exposing the III-V based compound to a gas plasma comprises the gases/etchants for to etch smooth high aspect ratio sidewalls (col 6, lines 42-54; fig. 1)

Shul differs from the instant claimed invention as per claim 11 by using a first gas of Cl₂ instead of HBr

Jewell, in a method for making surface emitting semiconductor laser, discloses etching the III-V based compound using Cl₂ or HBr (col 7, lines 47-49)

Hence, one skilled in the art at the time the invention was made would have found it obvious to substitute Shul chlorine gas/first gas with HBr in view of Jewell teaching because Jewell discloses that in the case of using InP-based material/III-V based compound, the Cl₂ chemically assisted etc would be changed to HBr (col 7, lines 46-49)

The limitation of claim 12 has been discussed above

Regarding claim 13, Shul discloses using dry etching/RIE etching (col 4, lines 1-3)

Regarding claim 14, Shul discloses generating the plasma using high-frequency power and bias RF power (col 52-62)

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Regarding claim 15, Shul discloses using a RF generator to provide power at 0-200 watts and a RF bias power at 150 Watts (col 5, lines 65-67; col 6, lines 40-42)

9. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shul et al (US 5,624,529) in view of Jewell et al (US 5,034,344) and further in view of Demmin et al (US 6,635,185)

Shul as modified by Jewell has been described above. Unlike the instant claimed invention as per claim 16, Shul and Jewell fail to disclose the specific concentration of the first gas/HBr

Demmin, in a method for etching semiconductor substrate, discloses that a parameter such as the gas flow rate may vary and effect on the result obtained (col 7, lines 15-20). Demmin serves as an evidence that gas flow rate is a result effective variable

Hence, one skilled in the art at the time the invention was made would have found it obvious to vary/adjust the concentration of the first gas in Shul and Jewell method in view of Demmin teaching because Demmin discloses that one skilled in the art of plasma etching can vary the flow rate/parameter accordingly to etch a desired material satisfactorily (col 7, lines 23-25). Also, it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. See *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CPA 1980)

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10. Claims 20-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shul et al (US 5,624,529) in view of Demmin et al (US 6,635,185)

Shul discloses a dry etching method for compound. The method comprises the steps of:

forming a mask 16 on the III-V based compound (AlInP) (col 4, lines 9-10, col 6, lines 33-35; fig. 1)

placing the III-V compound and the mask into a reactor having a pressure of 0.5 – 20 mTorr (which overlaps the claimed range between 2 mTorr to about 20 mTorr) (col 6, lines 9-10)

introducing a first gas of BCl₃ , CH₄/second gas and H₂/third gas into the reactor (col 6, lines 21-23)

exposing the III-V based compound to a gas plasma comprises the gases/etchants for to etch smooth high aspect ratio sidewalls (col 6, lines 42-54; fig. 1)

Unlike the instant claimed inventions as per claims 20-21, Shul fails to disclose the specific concentration /ratio of the second and third gas although Shul discloses that the relative flow rate/concentration of the gases are important in controlling the etch rate (col 6, lines 25-27)

Demmin, in a method for etching semiconductor substrate, discloses that a parameter such as the gas flow rate may vary and effect on the result obtained (col 7, lines 15-20). Demmin serves as an evidence that gas flow rate is a result effective variable

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Hence, one skilled in the art at the time the invention was made would have found it obvious to vary/adjust the concentration of the second and third gas in Shul etching gas mixture in view of Demmin teaching because Demmin discloses that one skilled in the art of plasma etching can vary the flow rate/parameter accordingly to etch a desired material satisfactorily (col 7, lines 23-25). Also, it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. See *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CPA 1980)

Response to Arguments

11. Applicant's arguments with respect to claims 1-6, 8, 10, 19 have been considered but are moot in view of the new ground(s) of rejection. The applicants argue that Tanabe does not provide any teaching as to the concentration of BCl₃. This argument is moot in view of the new ground of rejection based on Tanabe and Shul in which Shul discloses the concentration of BCl₃. The applicants argue that Tanabe does not teach the four-gas system of claim 8. This argument is moot in view of the new ground of rejection based on Shul since Shul discloses using a four-gas etching mixture

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Conclusion

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lan Vinh whose telephone number is 571 272 1471. The examiner can normally be reached on M-F 8:30-5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571 272 1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



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February 6, 2006